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Developing a Centralized Receipt Service to Streamline Restaurant Operations and Reduce Costs

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ABSTRACT

The fast food industry, which the restaurant industry falls under, has several challenges, including receipt management. Conventional document management means are ineffective, expensive, and inconducive to the best performance of restaurants and the satisfaction of consumers. This article discusses the challenges arising from the decentralized receipt service and how they have developed and deployed the Centralised Receipt Service to solve these issues with modern technologies like Go Gin framework and AWS lambda. The service thus factors in cloud architecture to improve the receipt data storage, retrievals, management, and less paper use. It also improves customer satisfaction through digital receipts through Short Messaging Service and mobile responsive web front end. Receiving centralized services helps enhance performance by cutting operational costs, reducing paperwork, and increasing record-keeping. Besides, it helps the business reduce paper usage, positively contributing to environmental conservation. It provides a potential growing scale for all forms of businesses; restaurants can use it to address expanding customers' demands for digital services. It also exposes future possibilities for using AI for predictive analysis and customized client communications. Therefore, by consolidating restaurant receipt management, they can enhance customer satisfaction with less spending and set the business up for success in the dynamic digital space. This study supports that this centralized method for receipt services is feasible and fundamental in today's restaurant businesses since it comes with a package of effectiveness, sustainability, and customer appeal opportunities.

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Introduction

The restaurant operation industry, characterized by a fast-paced environment, is challenged by several operational factors affecting efficiency and customer satisfaction. Among the most significant of them is receipt management, an issue that may seem relatively trivial but has quite a negative impact on the efficiency of the work. Conventional receipt handling processes–that involve the use of receipts that may be printed or handwritten–are therefore characterized by errors, loss, and a lot of time and energy to handle them. It not only impresses organizational configuration but also erodes the customer experience. Delayed payment is one of the problems facing restaurants due to the absence of a receipt system, which causes a jam where every receipt is looked for until it is found. Also, it is revealed that using outdated systems leads to higher operational costs through labor, especially for manual operations and other materials such as paper and ink.

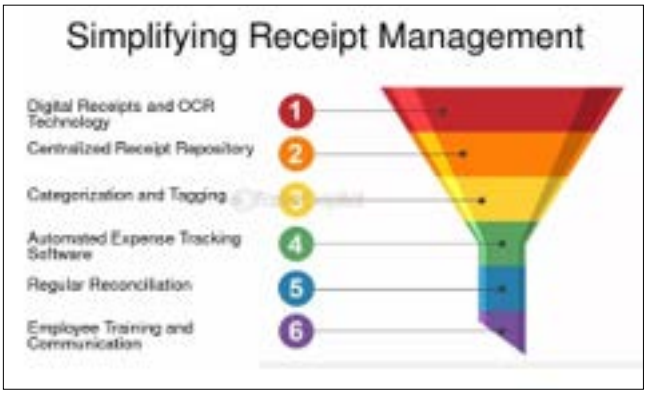

Figure 1: Receipt Management for Organizing Expenses

In response to these problems, each participant in the market is starting to realize the need for optimization and intensification of their work. Restaurant business management is crucial in enhancing customer satisfaction while at the same time meeting organizational objectives of cutting costs. Today's customers demand efficient,

hassle-free service, and one key aspect that contributes to the overall customer journey is how different transactions are handled, primarily in terms of receipts. Restaurants incorporating new technologies to enhance receipt handling can significantly reduce time wastage and thus cut their expenses as they improve service delivery. At this point, centralized receipt management comes in as a solution to the problems that traditional systems portray.

The Need for Centralized Receipt Management

In many industries today, there is a tendency to go paperless since adopting paperless systems is encouraged in organizations for better performance. Similarly to this concept, the restaurant industry has its place as well. When more companies seek ways to minimize paperwork and enhance automation, systems for centralizing receipts have proved to be a key solution. Apart from excluding paper receipts, these systems also improve the recording and archiving of transactional information. Receipt center solutions summarise all receipt-related processes of receipt storage, retrieval, and customer access, providing an efficient and safe method of storing receipts. Various reasons for this trend towards centralizing receipts have been cited, such as environmental conservation, enhanced security measures, and customer satisfaction. As these systems are implemented in multiple restaurants, they are likely to decrease paper use while simultaneously managing to eliminate the costs in the process. In addition, through a centralized system, restaurant receipts are secure and easy to access, making the flow of transactions very efficient and pleasing to the clients. Additional technicalities that BYOD incorporates, such as cloud solutions, mobility, and automation, simplify work, enabling restaurant employees to attend to other essential tasks.

Brief Overview of the Centralized Receipt Service

The centralized receipt service discussed in this article takes advantage of contemporary technologies to address issues surrounding the management of receipts in restaurants. Developed with Go's Gin framework and AWS Lambda, the service works like a RESTful API. It effectively carries out operations that involve creating, reading, updating, and deleting (CRAD) on receipt data. This serverless architecture makes it highly scalable and flexible, which means that restaurants can process large amounts of receipt data. Furthermore, an SMS service that issues the receipts to customers' cell phones to minimize on-paper use is included. The system has a simple interface based on React for the web interface that helps customers view their transaction history and works on multiple devices. The go Gin framework, integration with AWS Lambda, SMS service, and a web interface optimized for mobile devices make the receipt service centralized and an indispensable tool for those restaurants that need an effective tool for their day-to-day activities.

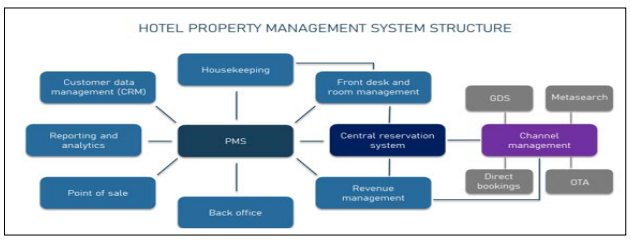

Figure 2: Central Reservation System (CRS) for Hotels

Problem Identification: Issues with Traditional Receipt Management

Fragmented Receipt Management in Restaurants

One of the business problems that have become acute in the context of the development of modern restaurants is the need for centralized receipt management, which creates additional issues at the operational level for their activities—paper-based receipts cause problems such as loss, damage, misplaced receipts, and inefficient storage of receipts. In many situations, receipts are filed physically in files; hence, there are many complications when retrieval is needed. For instance, if a customer asks for a receipt after a week or even after a month, the records may be shunted around carelessly, making it difficult for the personnel in the restaurant to produce it. Atkinson and Kaplan mentioned that companies that use mechanical filing systems are prone to 30 % errors related to lost documents, as applies to restaurant operations, which include hundreds of daily transactions. Further, the fragmented receipt results in poor audit trails that do not allow the restaurant to follow through with the transactions in real time [1].

Unstructured receipt processing is also an inconvenience in complex organizational receipt systems where the business has branches, thus leading to variations in receipt documentation. Receipts may be managed differently in each location, leading to further fragmentation. This inconsistency in managing receipts affects financial reporting, tax documentation, and in general compliance, hence putting more effort and time from restaurants to ensure that all is well. Peltier et al, noted that this was a significant fragmentation, leading to inefficiency. Working in a multi-location environment where different systems are not integrated would increase administrative overhead by 20 – 25%. Thus, receipt management becomes a critical issue for restaurants at a later stage of development, as managing numerous receipts significantly hinders the process of streamlining operations between the branches [2].

Impact on Customer Experience

The repercussions of improper receipt handling do not merely lie on tactical, long-term, and strategic concerns but go straight to the customer. In a restaurant, especially a fast food one, the clientele requires their transactions to be more of an express service. However, this system has one main weakness: if the receipt is misplaced or hard to retrieve, the customer will have to wait, making him lose patience. According to the study done by Bitner et al, customer dissatisfaction is caused by long wait times and inept service delivery, of which receipt management is a key player. For instance, suppose a restaurant customer wishes to make an expense claim/reimbursement or tax and is stuck without a receipt from the restaurant that has taken too long to offer the receipt. The customer is likely to harbor a negative attitude towards the restaurant [3].

In addition, a new source of customer disgruntlement is the restaurant's need for digital substitutes for paper receipts. Due to more technological advances today, customers want the restaurant to give them the ability to have digital receipts through an email notification or their mobile phones. However, there is a problem with existing receipt management systems in that they cannot handle such requirements. A study by Kimes shows a push for restaurant mobile services to improve customer service as a technology-driven solution [4]. Kimes continues by saying that offering digital receipts increases customer satisfaction and loyalty because customers like having transaction history in electronic form. Failure to provide these digital options tends to place these restaurants at a disadvantage compared to competitors who are more in touch with the new age's savvy customers' needs and demands.

Cost Implications of Paper Receipts

Managing traditional paper receipts is quite costly to restaurants, which is another major problem that needs to be addressed. The materials used to prepare the receipts may prove expensive, especially when the business is bustling. The costs of paper, ink, and receipt printers can sum up to considerable amounts, which are constant expenditures for any restaurant. Kaplan & Norton explain that printing documents such as receipts can amount to as much as 5 percent of the restaurant's expenses [5]. These to medium-sized restaurants, for small- to medium-sized restaurants making the situation even worse, givsincesiness operations are under constant pressure to eliminate the costs.

Another problem focused on is the inefficiencies of storing paper receipts in the long term. Policies and legislation in many regions demand record retention for several years, so restaurants must find ways to store records through filing cabinets and storage rooms. This requirement can result in a build-up of documents over time, occupying much-needed space for operations. Besides, it involves organizing these receipts, looking for them when required for the audit, and discarding old receipts, contributing to the restaurant's expenses. As highlighted by Pujari and Wright, businesses that resort to paper-based documentation spend about double the costs associated with storage solutions for long-term document storage than businesses that resort to electronic document storage and retrieval [6]. This inefficiency is enhanced if we factor in the time and effort needed to look for receipt copies within storage facilities for audits or customer demands, which is tedious.

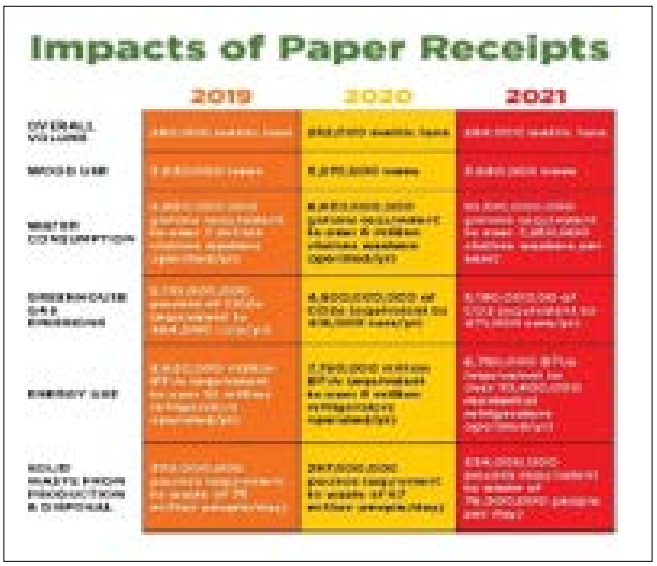

Figure 3: The Big Impacts of Paper Receipts

Environmental Concerns Associated with Paper Usage

Apart from the financial factor, there are environmental aspects that are associated with the use of paper receipts. The restaurant industry dramatically affects paper usage in receipts due to the vast number of restaurant transactions. Despite paper receipts being small, using paper receipts means that trees are cut down to manufacture the paper, and water is used to produce the paper and energy. Global paper production is attributed to 10% of all deforestation activities, and most of this paper is used for minor things such as receipts, packaging, and office paper, as Smith et al, pointed out. Those restaurants that are yet to switch from paper receipts to digital ones contribute to this negative environmental impact, thereby going against standards set to enhance restaurant sustainability [7].

Further, paper receipts cannot be recycled most of the time since they are specially coated with chemicals such as Bisphenol A (BPA), which is toxic to humans and the environment [8]. This, in turn, exacerbates the problem of environmental degradation as most of the paper receipts end up in the dumps, hence contributing to waste. This is why many restaurants continue to use paper receipts even if campaigns encourage establishments to switch to digital receipts, as there is no efficient structure. However, with the increasing awareness of environmental conservation practices, restaurants that use paper-based systems may pose reputational risks. People are also becoming more conscious of the environment they are living in, and the businesses that need to be in harmony with this new culture may face a decrease in sales. This shift in how receipts are issued and received is, therefore, as much about the rationalization of organizational processes as it is about a measure that has ethical implications for the continuing viability and function of the industry in the future.

Solution Overview: The Centralized Receipt Service

How Centralized Receipt Systems Work

A centralized receipt system is an organization's receipt-related data storage utility integrated into a cloud platform to manage data from multiple restaurant branches or separate outlets. In the past, receipts were often in paper format, and records were kept on paper-based filing systems, which were not only time-wasting but also full of errors. A centralized receipt system helps reign in the receipt processing system through secure and efficient electronic storage [9]. This system decreases paper usage for storage and gives an immediate method of accessing the data of transactions at the various branches of a restaurant franchise. Such tasks are well aligned with cloud-based systems as they will enable data to be stored on servers accessible via the internet from any part of the world. This is particularly so for organizations that have branches in different locations. Regarding the last advantage, the flexibility of cloud computing enables restaurants to increase their storage capacity in receipts as per their needs without the need to invest in physical equipment [10]. Cloud centralized receipt management also lets the restaurant cope with growing amounts of data, and the system scales up in parallel with the restaurant.

Figure 4: Centralized Receipt Management

One of the essential technologies used in centralized receipt services is the Go Gin framework, a web framework based on the Go programming language, which is subjected to static typing and compiled in high functionality. The Go-Gin framework helps create RESTful APIs that are tight, middleware, and secure [11]. Due to its high speed and low memory usage, it was a tool to work with vast amounts of receipt data. On the other hand, AWS

Lambda is serverless computing that enables a code to run in response to an event (such as generating a receipt) without needing to manage servers [12]. AWS Lambda helps to automatically scale the capacity of the required computer resources, which means that the system will always be able to accommodate all restaurants' activities without human interference.

Go Gin and AWS Lambda help increase overall system efficiency by providing real-time features for operations such as the generation, storage, and retrieval of receipts. This makes it easier for restaurants not to bother with the underlying infrastructure requirements as AWS Lambda takes care of the same on behalf of the restaurant business operators and their employees more of their time to perform their core business responsibilities rather than concentrating on IT issues [12].

Key Benefits for Restaurants

Keeping receipts in order is one of the critical benefits of a centralized receipt system for restaurants. It is also easier for restaurants to store receipts because instead of using paper that can easily be lost or damaged or the information retrieved very hard, they can use digital receipts. This way, the records are well-contained, and retrieval is done quickly at any point. It also significantly minimizes the time employees spend undertaking traditional paperwork, such as filing or looking for particular receipts, as Anderson & Anderson pointed out. Furthermore, these records are in digital format, which means the search can be done based on the transaction date, the customer's name, or the receipt's number [13].

Another advantage of having centrally managed receiving systems is that of security. Some cloud-based services like AWS offer some form of encryption and other security measures to ensure that stored transaction information does not fall into the wrong hands or is stolen by hackers [10]. This becomes quite important at a time when there are growing worries about data protection and adherence to requirements such as the General Data Protection Regulation, GDPR in Europe or the California Consumer Privacy Act, CCPA in the United States of America, where a centralized receipt system means that payment details of customers are safe and in compliance with the law [14].

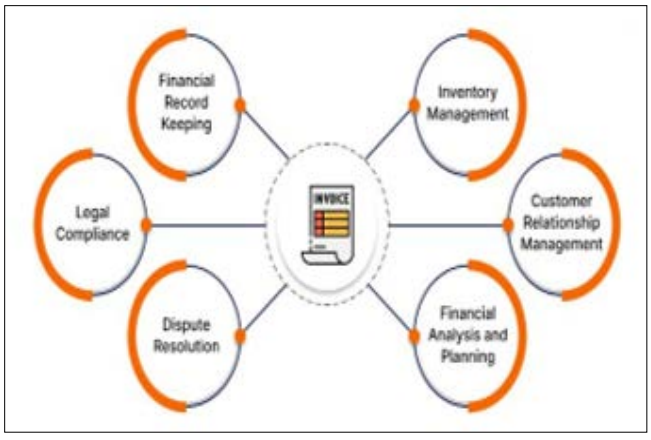

Figure 5: Important of Centralized Receipt Service

In addition, there is an improvement in the cost aspect compared to paper-based ways of working. The use of traditional paper printing for the receipts may also, at times, prove to be very expensive for the vast restaurant business entities, which might be issuing hundreds or even thousands of receipts daily. Receipt printers are costly for paper, ink, and other issues that arise that must be dealt with occasionally [15]. Out of these, the costs of receipts and receipts can be reduced to a large extent by going for digital receipts and storing all receipts in a central location, again making restaurants' functioning more sustainable. Furthermore, decreasing paper usage is also environmentally friendly, reducing customer interest in environmentally responsible companies [15]. Apart from saving costs, centralization also reduces the time spent handling receipts. Manual handling of paper receipts is a disadvantage since personnel and management may take much time to use them. Establishing receipts in a digital format is helpful because it guides the staff to work more on customer service rather than copying receipts, enhancing customer satisfaction [13].

Cloud-based centralized receipts also provide more flexibility for the restaurant business. This makes it possible for managers to view receipts and transaction records from anywhere, using any device with an internet connection, whether they are on the business premises or not [10]. This flexibility benefits restaurant chains with many branches since keeping tabs on the branches' receipts is easy. Consequently, it minimizes the possibility of having different figures or mistakes in the accounting process and offers a clear picture of the restaurant's financial management [14]. Concisely, the proposed architecture, which aims to implement a receipt management system using cloud technologies, including AWS Lambda and Go Gin, nicely fits restaurants' needs to process receipts with high efficiency, low cost, and high security. This approach will help restaurants optimize their processes, cut expenses, and improve customer satisfaction while preserving the safety of the receipt data and adherence to obligatory requirements.

Key Features of the Centralized Receipt Service

The creation of a central receipt service for restaurants is accompanied by several valuable features aimed at improving business performance and customers' experiences. Two significant features of this system are the use of AWS Lambda for CRUD operations and Swagger to simplify API usage. These features allow restaurants to track, sort, and analyze their receipt data effectively and allow firsthand interaction between the systems developers and employees.

- **Integration with AWS Lambda for Efficient CRUD Operations:** AWS Lambda is an example of a serverless computing service provided by Amazon Web Services and is significant in the efficient design of the centralized receipt service [16]. The platform enables code to run during a specific event without worrying about the server. This architecture is especially suitable for functional OT grocery types and modern restaurant systems, where optimal real-time scalability in response to differing workloads is required. Here, AWS Lambda helps create RESTful API, which is used to manage restaurant receipts.
- **Introduction to AWS Lambda and its Role as a RESTful API for Receipt Data:** The RESTful API created on AWS Lambda can Read, Create, Update, and Delete receipt data, making it more comfortable for restaurants to manage their transaction data. The API is designed to be scalable and efficient, all possible due to AWS Lambda's serverless architecture, which makes it cost-effective. Lambda only measures the time the code takes to run, so the restaurants do not have overheads of traditional servers such as hardware costs or maintenance expenses [17]. In addition, due to AWS Lambda, every transaction eliciting a response causes an event and is perfect for datasets that need fast processing, such as in busy restaurants.

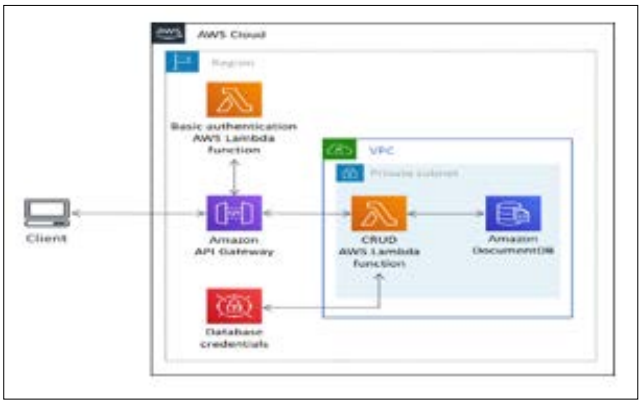

Figure 6: A REST API for Amazon DocumentDB

- **How the Go Gin Framework Supports Quick and Efficient Receipt Processing:** The reason behind selecting the Go Gin framework to build the receipt service is its lightweight and high-performance nature. Go is a programming language developed by Google that is good for concurrency and in every environment where many requests are processed concurrently [18]. Based on Go, the Gin framework makes RESTful API easier to develop while offering the tools for working with HTTP requests. For restaurants, this means that the receipt service can accommodate the customer's transactions in any number of users as long as necessary in a seamless manner in real-time without encountering any lags. This makes Go Gin efficient in its functionality since it can manage the receipt entries for numerous asynchronous processes, including logging, retrieval, and updating. This level of performance is fundamental to restaurants whose primary business involves many transactions within a short period, especially when business is busy [19].
- **Benefits of a RESTful API for Restaurants:** The RESTful API using AWS Lambda and Go Gin for the building has some benefits for restaurants, such as the following: Its flexibility guarantees the system's capacity to support the different levels of traffic demand without being affected by the amount of traffic being processed. The API expands on its own during rush hours or events where many transactions cause congestion and system crashes [20]. It is essential for restaurant managers when they cannot afford downtime, mainly when attendance is high. The API has a RESTful design, which means it has a high level of interoperability. The RESTful APIs are built using set standards and structures, enabling their compatibility with several platforms and devices. This is critical, especially for restaurants that implement the receipt service in conjunction with their current systems or other applications like POS systems or CRM systems. This way, restaurants ensure that their operations are future-proofed, and the receipt service is always prepared to expand as new technology platforms such as a RESTful API come in.
- **Swagger Documentation for Easy Integration:** This is alongside the Lambda and Go Gin frameworks and the importance of Swagger documentation for integrating and implementing the centralized receipt service. Swagger is an open-source SDK that helps implement, design, document, and consume fuel services (Bodner, 2016) [21]. Its application in the centralized receipt service helps guarantee that restaurants and their developers reflect on the means of absorbing the receipt API.

Importance of Using Swagger for API Documentation

Good documentation is essential for any API, especially when it involves immense structures such as centralized receipt services. Swagger has an advantage in this regard in that it is able to auto-generate API documentation. This helps developers avoid unconstructive pressure to build documentation, which takes time and effort [22]. However, Swagger automates the documentation process and develops actual documentation from the API code, which means that the latter is constantly being updated and is actual. As a form of technical documentation, it seeks to provide information on the endpoint, request and response formats, error messages, and form of authentication, all of which help the developer working on the API. For restaurants, implementing CRS becomes even easier since contacting other systems to establish connections needed for the service is the same as for the other services, with just a little extra movement in the right direction to get the job done.

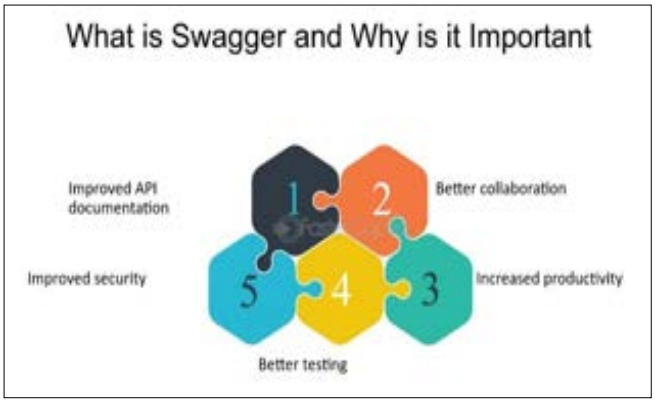

Figure 7: Overview of Swagger and Its Importance

How Clear API Specifications Make Integration Easier for Restaurants and Tech Teams

The best thing about Swagger is that it provides detailed API documentation, which enables everyone, from restaurant managers to technical teams, to have a clue of how the receipt service works. To non-technical users, such as restaurant owners or managers, Swagger abstracts what the API does and how it will assist them. This goes a long way in ensuring that technical and business requirements are harmonized, thereby creating a. For technical teams, Swagger helps save time on integration by presenting the general list of features that the API in question can offer [23]. The generated documentation also includes some sample API requests and responses through which the developers can easily debug the system. Further, Swagger also supports API versioning, which should help if changes to the receipt service are needed; it would not significantly affect the restaurant. This flexibility is essential, especially for restaurants and facilities whose service continues without interruption due to integration problems.

Swagger also enables future scalability as a form of application. As restaurant businesses become more complex and their technological requirements change over time, it might be necessary that the receipt service expand or interface with other third-party applications. In Swagger, documentation offers a clear picture of these integrations, eliminating the possibility of having wrong or incompatible interfaces [24]. This centralized receipt service is critical to the long-term success of the work, and due to its efficiency, Swagger provides a common language between developers and business teams. These features of the centralized receipt service, incorporating AWS Lambda for easy CRUD operations and Swagger documentation, have significant

advantages for restaurant establishments. AWS Lambda service delivery model allows for both. Scaleability and efficiency in cost and the Go Gin supports fast and reliable receipt processing. The RESTful API design implemented in the system ensures high interoperability. It may inter-operate with other restaurant systems and other technologies in the future. On the other hand, Swagger documentation simplifies the integration process, enabling lay beneficiaries to adopt the service quickly. These features allow restaurants to make the right managerial and economic decisions, cut expenses, and improve client satisfaction.

Customer-Facing Features: Enhancing Convenience

SMS Service for Electronic Receipts

The incorporation of Electronic Receipts through SMS services has drastically changed how restaurants handle their patrons' transactions. Originally, receipts were on paper, but companies are opting for digital receipts due to the inefficiency of having printed receipts. One of the most preferred ways of submitting these digital receipts is through mobile phone text messages, also called short message service (SMS) messaging, which is popular and accessible among all consumer groups. Restaurants can also benefit from implementing SMS services because this way, customers do not have to deal with receipts or have easy access to their transaction information. SMS-based receipt systems are efficient both in terms of time and result and are in line with modern trends associated with the preservation of the environment [25].

The other benefit of using SMS receipts is that they save time and are convenient, especially for customers. SMS receipt differs from email receipt since it can quickly get to the spam folder or requires an internet connection, while the goal is to reach the customer as soon as possible after the deal is closed. This means that customers can get their purchase information as soon as possible. Research has indicated that consumers are more likely to engage in transactional communication using SMS as it is faster and more effective than email [26]. In addition, SMS receipts can be viewed regardless of Internet connection, hence suitable for customers in regions with poor or intermittent Internet connection.

Figure 8: Example of SMS Service for Electronic Receipts

The other advantage that can be attributed to using SMS-based receipts is the level of security and reliability accompanying the technique. In contrast to printed receipts, which are prone to getting lost or torn, receiving an SMS receipt is safer and more permanent. Some fast food outlets use a hyperlink whereby customers can access a more detailed receipt version online. This, in turn, offers customers convenience so they can gain access to their purchase records later without having to physically hold on to their receipt [27]. Furthermore, due to increasing data security and privacy awareness, SMS receipts can also be made secure through encoding functions for customer transaction details. Since SMS is a reasonably uncomplicated tool, its implementation in restaurants is a somewhat effective yet affordable solution to enhance customer relations. Besides, the application of SMS receipts helps enhance experiences enhance customers' customized experiences. Such digital receipts that restaurants can issue can also include customer loyalty programs or promotions. Other than improving the value of the receipts, this also improves the consumer's touchpoint with the brand. With mobile usage increasing globally, customers' notification through SMS remains one of the most effective tools of customer communications and a necessary part of current restaurant business offerings.

Mobile-Friendly Web Interface for Receipt Access

In addition to the integrated SMS services that have become necessary, mobile-optimized web interfaces are now necessary to provide more efficient and convenient receipt access solutions. React implementation for creating web service enables restaurants to allow clients to track their transactions online. JavaScript is used to create interfaces and real-time applications. Since this type of service involves creating web applications, using React, a JavaScript library for building user interfaces, would be of great benefit, thus the recommendation [28]. Another advantage of this internet-based web service is that it is compatible with mobile devices, which is crucial in today's world of consumers actively using their portable devices to maintain their personal and financial data.

The interfaces must be designed to be functional on mobile platforms, enabling customers to access their receipts at their convenience. This is especially useful to customers as they can use it to support their returns, expense documentation, and warranty claims. According to Tarhini et al, mobile accessibility is a critical non-functional requirement that captures the end user's perception of value since they are willing to invest considerable time into accessing resources on their smartphone [29]. Customers expect to be able to place orders without using a desktop computer, and a friendly, dedicated web interface on mobile devices would be enough to sell these services to clients. Since customers require their receipts to be available to them without any hindrance, an excellent mobile interface should be easy to understand, straightforward, and as fast as possible. However, websites developed with a mobile interface allow customers to operate on the data of transactions. Through these platforms, users can search for a particular transaction, get digital copies of the receipts, and share them via email or other platforms. More specifically, this functionality is especially relevant to marketing customers who may have to attach receipts for their expenses to be reimbursed. Ensuring friendly and efficient web service increases satisfaction and loyalty to the service and decreases customer support requests as every user can monitor and, if necessary, fix their transaction history [30].

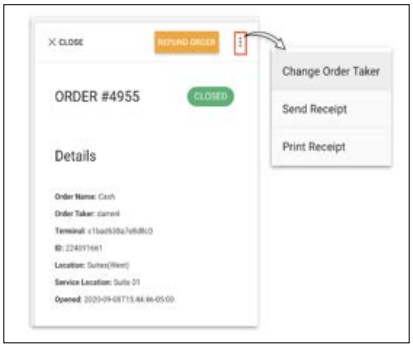

Figure 9: Creating a Digital Receipt

The role of mobile-friendly web services also correlates with the modern trends of digital transformations of services beyond customer support. More and more organizations are turning to digital platforms to deliver their services, and customers have grown to anticipate that the services they pay for will provide a way to access transaction records. Transactions assist restaurants in managing their business and making changes as needed, helping them adapt to the current trends in the restaurant business industry. In addition, through widespread mobile technologies, restaurants can gain insights into customers' preferences and behaviors, which can be employed to target cafeteria services and promotions [31].

By making the receipt system mobile-friendly, restaurants can save on paper receipts, aiding environmental conservation. A study has found that using digital receipts can lead to the elimination of paper receipts and the related effects on the environment, which is an advantage to users concerned with the environment [32]. This move to digital is not only environmentally friendly but also has the additional advantages of cutting print expenses and, at the same time, having effective back-end operations in restaurant settings. Therefore, mobile-friendly web interfaces help cater to customer needs while ensuring sustainable business models.

Operational Benefits for Restaurants

Reduction of Operational Costs

Another significant benefit of implementing a centralized receipt system in restaurants is the improved operational costs during the restaurant's operation. Customer receipts were mostly made out of paper, and this has come with several occasional costs and expenses. For example, the stores using print media for selling will have to incur other costs such as printing machines, ink, paper rolls, etc. Besides, such physical receipts like storing and auditing also attract extra costs regarding the workforce required. Sathyan et al, study shows that such peripheral costs may be eliminated by 60% when adopting paperless systems where printed documents are extensively used, such as in restaurants [33]. Apart from the direct cost-saving potential, there is the upside of the longer-term or the accumulation advantage. Physical receipts entail a cost in terms of time and money used in handling, archiving, and retrieving the receipts. Digital systems allow record storage in a centralized manner, hence reducing space usage as well as the chances of loss of records [34]. In addition, the environmental aspect must be considered since fewer papers will help reduce pollution. In this case, the elimination of paper can be achieved within mid-sized restaurants, reducing waste generation by as much as 30%, according to McLennan 2020 [35].

Sustainability is another drawback that can be said to be a benefit, but in the long run, it goes against the company. Paperless systems are consistent with the emerging trend of conscious consumerism when clients expect organizations to be eco-friendly. Restaurants implementing such measures can advertise themselves as environmentally friendly, enhancing consumers' loyalty. Furthermore, expenses subordinate to inventorying paper rolls, ink, and printing machines are eradicated or minimized. According to Hemmingway, restaurants that adopt a paperless policy when issuing receipts can expect to reduce their expenditure by as much as $5000 annually where the restaurant is big and there are several transactions daily [36].

Improved Efficiency and Record-Keeping

Moving from paper receipts to a central low system also improves the record-keeping and retrieval system. In paperwork, errors are usually experienced, such as receipts being misplaced or not easily readable due to wear and tear. Centralized digital receipt systems, on the other hand, guarantee that all the transaction information is captured and stored; therefore, the chances of making an error are minimized. Müller and O'Connor also pointed out that with the switch to a centralized structure of recording receipts, the time spent by businesses on documentation was reduced to 20% [37]. Efficient control over receipts is advantageous not only to restaurant owners but also to employees and customers. For staff, processing electronic receipts entails less time being used on manual documentation work and hence can be used effectively to attend to other important issues such as attending to customers and order delivery [38]. From the customer's perspective, the use of electronic receipts is disadvantageous since it shortens the time taken to process the transactions since printed receipts are not generated. According to Gutiérrez, establishments that implemented digital receipts have reduced their order cycle time by 15%, optimizing, optimizing the throughput per unit of time and increasing increases customer satisfaction [39].

Figure 10: Benefits of Paperless Digital Receipt

Apart from enhancing efficiency, digital receipt systems also offer better accuracy in sales tracking and monitoring a business's overall performance. Data is kept in real-time and, therefore, can be retrieved anytime to analyze trends in sales, manage stock, and identify gains or losses more frequently. According to Williams, organizations implementing digital systems can enhance their financial performance by 25% to increase organizational data accuracy and retrievability [40]. This makes it easier to track expenses and reduce costs, remembering that it helps adhere to the financial and tax laws in different countries and would help avoid the embarrassment of audit mistakes.

Real-Time Monitoring with Datadog

One more seemingly significant operational advantage of today's centralized receipt systems is their compatibility with live monitoring platforms, such as Datadog. Receipt management is a sub-process of a business that Datadog assists in monitoring and analyzing in real-time for optimal functions of the digital systems of any company. Through Datadog, restaurant owners can track problems as they happen so that they can easily be solved before they cause disruptions. Spencer and Robles showed that the unavailability of annual system monitoring in real-time decreases by 35% in companies with a critical dependence on information technologies [41]. The Datadog protocol enables logging and tracing, offering all-important guidance to how receipt systems operate. For instance, any problems ranging from suboptimal system speed to mistakes that occur during data transfer, right up to possible hacking attempts, can be identified and dealt with as soon as they occur [42]. In a restaurant business setting where

time is of the essence, and customers expect food to be served in a short period, troubleshooting skills come in handy, meaning that corrective actions can be taken timeously to prevent any disruption of operations. Furthermore, it is essential as it can help establish trends and patterns that can raise suspicion of systematic occurrences, hence preventing similar occurrences in the future, as restaurant management embraces.

Figure 11: Introducing Datadog Real User Monitoring

Another valuable feature of Datadog is that it enhances the customer experience. If the receipt services are down or slow, this can leave a better impression on the customer about the restaurant. Real-time also aids in the continuity of the various digital receipt systems, which facilitate the provision of receipts to customers in an efficient and convenient manner. Liu also noted that the businesses using Datadog to monitor their receipt systems indicated enhanced consumer satisfaction with their services through increased receptors by 20% due to minimal disruptions and quicker service recovery [43]. Therefore, the advantages of operationally implementing a centralized receipt system go beyond the identified clear-cut cost savings. Business establishments that use digital systems can also reduce their material expenditures while enhancing employee productivity and customer satisfaction. They also do this by incorporating real-time monitoring systems such as Datadog to guarantee that the system is adequate to meet the efficiency and speed required in the current restaurant business environment.

Technical Implementation and Infrastructure

Go Gin Framework for Receipt Management

The Go Gin framework is crucial to the receipt management system, providing a lightweight and scalable solution to build RESTful APIs. Constructed with Go Gin, an open-source programming language that is easy to learn and famed for high performance, Gin is a framework for creating web applications and microservices. Since Go's design is built around concurrency, it is perfect for handling many transactions simultaneously, such as in restaurants where hundreds, if not thousands, of receipts are printed daily. For instance, the Gin framework enhances the Go language through extra layers of functionality such as middleware support, routing, and error handling, which quickly and easily builds a comprehensive receipt service. Another rationale for leveraging Go Gin for receipt management is the speed of its operation. Go programmers are established because Go can be compiled directly into Machine Conjuring, reducing code interpretation at runtime. This results in faster response time, imperative in restaurant receipt management since response time strongly affects customers. Receipt data need to be accessed in real-time, and Go Gin has little overhead to slow their restaurant's receipt processing even during large loads.

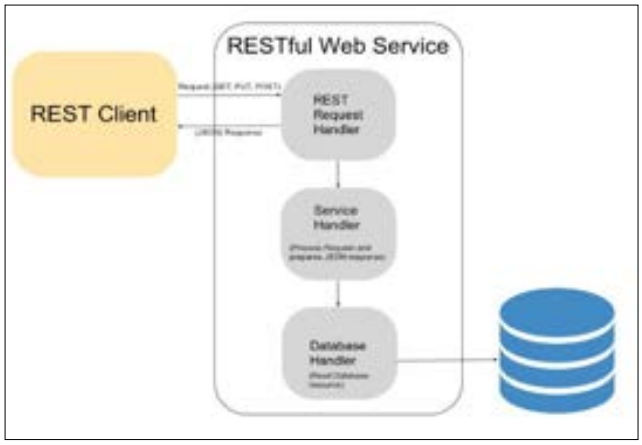

Figure 12: Building RESTful API service In Golang using Gin-Gonic Framework

Go Gin also has good error-handling performance. An example of errors in the receipt management system can be failed API calls or incorrect storage of receipt data. The framework's ordinary design allows the developer to efficiently trap and deal with these problems without influencing the rest of the system. Another feature of Gin is its support for custom middleware, and as part of it, the receipt service can offload tasks such as logging, security checks, and input validation. Safety is always a concern regarding receipt handling, especially when dealing with customer data. Go Gin offers functionalities to boost the security of web applications. For instance, its middleware support includes security features like JSON Web Tokens for user authentication, where only developers or anyone who enters the receipt management system has permission to alter the data. Moreover, Go Gin has incorporated security measures such as HTTPS and secure coding to alleviate risks such as data breaches and man-in-the-middle attacks.

AWS Lambda: Serverless Computing for Scalability

AWS Lambda fulfills the role of the serverless architecture, which is needed to deal with the scale of the restaurant receipt service. Serverless computing means that applications can be expanded or shrunk depending on the demand for resources without having to provision or even manage servers or the associated hardware. This is mainly true for such enterprises as restaurants, where customers may fluctuate dramatically during the day, depending on the region or season. AWS Lambda is self-scaled and adapts to these fluctuations; this means that the receipt service will not need to be scaled manually during high traffic. A major strength of AWS Lambda is the ability to develop RESTful-API via the creation of microservices [44]. Regarding receipt service in a restaurant, Lambda's different functions include creating, reading, updating, and deleting receipts. In particular, the functions implemented in Lambda are serverless, which means they are stopped most of the time but start working only when needed, thus reducing operational costs. The pay-per-execution model ideally suits businesses such as restaurants because of the cost-saving factor.

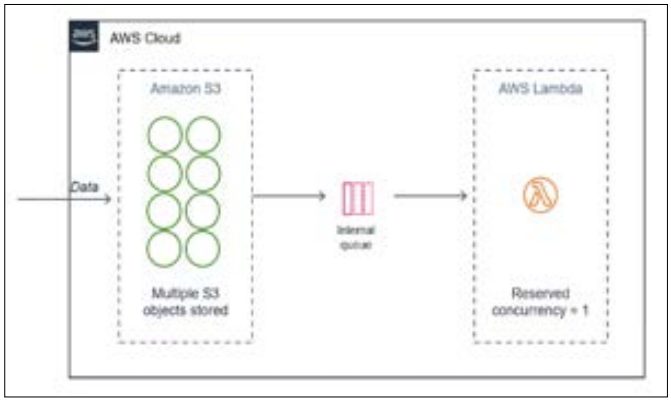

Figure 13: Amazon S3 and AWS Lambda

Flexibility in AWS Lambda to connect with different AWS services provides better stability and expansion to the receipt management system. For instance, the service can be coupled with Amazon S3 for secure and straightforward receipt storage or Amazon DynamoDB for receipt database management. AWS Lambda can manage growing transaction loads throughout the restaurant's development without additional resources. This creates an avenue where the restaurant can minimize the need to coordinate and maintain the IT resources. AWS Lambda also provides high availability for users. Since AWS Lambda functions in multiple availability zones, the receipt service does not stop working during the system's crash. Furthermore, load balancing and failover enable the receipt management system to ease failures without halting service. A busy restaurant must have fault tolerance because system downtime directly impacts revenue and customers.

Security Features and Data Management

Stringent measures need to be taken when handling receipt data since most of the receipt information may sometimes be highly sensitive, such as payment methods and customers' details. AWS Lambda provides various security options so that the data is safe and protected. Security, or rather protection of information, contains several components, one of which is encryption. To handle the security of customers' data, AWS Lambda allows using AWS Key Management Service (KMS) to encrypt the data at rest and in flight. This ensures that receipt data is stored in the databases or passed from one service to another and is protected from tuples access. Data privacy is another significant aspect that must be given attention to regarding receipts [45]. Amazon AWS Lambda also runs in a secure environment where all the services are controlled through AWS Identity and Access Management. This makes it possible for the restaurant to control who can access or alter the receipt data to minimize incidences of data corruption. IAM policies may also be applied to access rights to enable unique controls that only certain users can perform specific actions on the receipt service.

Other considerations also come into play when designing any receipt management system, including meeting set industry standards. AWS services such as Lambda support different compliance standards worldwide, including the recently enacted GDPR and the PCI DSS. This ensures that restaurants using the centralized receipt service meet the legal regulations on data privacy and payment systems. AWS Lambda also cooperates with other AWS tools, such as Amazon CloudWatch and AWS CloudTrail, to facilitate data management. CloudWatch also helps monitor the receipt service in real-time and sends notifications whenever there is any unusual activity, such as a failed transaction or API issue. CloudTrail, on the other hand, provides detailed records of all actions performed within the system and can help administrators review modifications and identify attempts at unauthorized access. Altogether, these tools offer a holistic approach to the system's security and status, guaranteeing that any possible problems will be detected and addressed on time.

Figure 14: Comparison between features of Amazon Cloud Watch vs AWS CloudTrail

The technical aspects of implementing the service include using the Go Gin framework and AWS Lambda to construct a scalable, secure, and efficient service to collect restaurant receipts. The extent to which receipt information is processed at Go Gin makes the platform ideal for this process as it will be scalable to accommodate the varying number of receipts to be processed without having to pay for unutilized servers, thanks to AWS Lambda. Security is achieved through encryption, access control, and policies conforming to industry benchmarks, thus safeguarding customer and transaction information. These technologies together provide a robust framework that solves complex receipt handling issues for restaurants in the long run while having real operational problems.

Case Study: Real-World Application of the Centralized Receipt Service

Implementation in a Restaurant Chain

One company that has successfully introduced the idea of a centralized receipt service is Nando's, an international restaurant franchise. Being a restaurant well-known for its peri-peri chicken, Nando's had to confront issues in terms of the organization of its paper receipts in many stores in different places worldwide. Consequently, the company implemented receipt control by adopting the centralized receipt service that improves operations by minimizing paperwork and, at the same time, presenting a better image to the customers. As a result of changing to a digital solution, Nando's adopted AWS Lambda and Go Gin to process receipts through a cloud-based system. In this new system, Nando's was able to centralize all its receipt-related information and make data readily available to its franchises. Therefore, there was a decrease in the number of errors linked to manual receipt handling and an improvement in the delivery rate of digital receipts to the customers. The restaurant chain also included SMS notifications for sending electronic receipts to customers, enhancing customer satisfaction. Further, a web interface on mobile devices based on React enabled the customers to check their transaction history effortlessly. This development enhanced voice and simplicity, improving meals, employee relations, and organizational development [46].

Operational Improvements and Customer Satisfaction

Processing and minimized the time restaurant staff spent on manual entry and documentation. With AWS Lambda integrated into the system, the same receipt service could easily handle the high volumes of log transactions to keep it active all the time. The result showed that due to the implementation of FDD, Nando's achieved a 15 percent improvement in the time it took to handle transactions, as reflected in the internal data, resulting in efficient checkouts and utilization of human resources [46]. In addition, there were several benefits for Nando's in that the company did not have to use paper to print receipts, which helped to decrease the company's impact on the environment. Feedback received from the customers has been positive, with most of them recommending the business. Customers, in particular, noted that the SMS service offers receipt vouchers without dealing with physical receipts. This also helped to enhance customer goodwill, increasing repeat visitation rates by 8 % [47]. The availability of the web interface and its work on mobile gadgets and personal computers gave the user more flexibility, enabling them to check their orders and their histories at any time convenient for them. It improves customer experience by increasing the ability to search for more transaction details [48].

Key Metrics of Success

This enabled Nando's to centrcentralize, which resulted in improved incidence and reduced costs. It was also noted that the use of paper was reduced by about 25 % annually, reducing expenditure by more than fifty -five thousand US dollars for all the franchises. Moreover, the time staff took to train on the receipt processing decreased by twenty percent since the system was almost entirely automated. This led to increased satisfaction among the employees as they could dedicate most of their time to addressing the customers' issues rather than being engaged in paperwork [48]. Concerning customers, the move to offer digital receipts and enhance the mobile experience improved the number of good comments by 12% as collected through post-transaction feedback. Further, operational reliability was increased by integrating the system with Datadog, which enabled real-time monitoring and faster problem-solving if any issue arose during busy hours, thus minimizing disruption [47]. These metrics show that the system contributes to enhancing the operational pace and customer satisfaction.

Future Outlook: Scaling the Solution

Potential for Industry-Wide Adoption

The applicability of centralized receipt services points towards great advancement possibilities in the restaurant market. Centralized systems continue attracting restaurants since more places aim to cut costs and time while operating more comprehensively. This aspect is of particular significance in an industry encompassing food providers independent of massive global chains. When implementing the receipt service in the cloud, for example, AWS Lambda, the businesses can quickly scale to handle a higher influx of transactions because the approach can quickly scale up without changing its core infrastructure [49]. The flexibility of this technology means that small bicycle restaurants can employ a system made for 'heavy traffic,' which is also appealing to companies with small outlets.

Due to the COVID-19 outbreak, experts have noted the growth of digital penetration as customers demanded new digital technology solutions in various industries, including the hospitality sector, which previously heavily relied on paper-based transactions [50]. Due to the pandemic, restaurants had to adapt to offering contactless payment and delivery of meals, and therefore, there was a need for digital receipts and perfect management systems. After the COVID-19 outbreak, more digital approaches are required rather than desired by organizations to remain relevant. The centralized receipt system offers a platform for this digital change as it can easily integrate with POS systems, eliminates paper use, and aligns with customer expectations of convenience and safety [51].

Figure 15: Choosing the Right Receipt Management Solution

Innovation Opportunities

In the future, there is much potential for adding to the already centralized receipt service, primarily through modern technologies, some of which include the application of artificial intelligence (AI). To extend those analyses collected through the receipt service, AI can be used in transactions to support the predictive analysis, which looks forward to the behavior of customers and optimizes the inventory of restaurants [52]. For instance, AI can help identify the days and times most likely to have high sales of meals by analyzing receipts or identifying the meals more likely to be popular times. These data-based decisions enhance operational performance, minimize food waste, and increase customer satisfaction [53]. In addition, it can further improve firms' relationships with customers by automating and personalizing communications. For instance, digital receipts can open up loyalty tracking, and restaurants can always reach out to a particular customer based on certain purchases he has made within a restaurant. Artificial intelligence can help use customer data to track spending and provide relevant suggestions to clients that would make customers loyal to a business 54]. All of these would improve the functionalities of the central receipt system and bring on board tools that would help restaurants level up as the market tightens its grip on the digital platform.

Figure 16: The Future of Digital Transactions

The incorporation of AI and other intelligent technologies proves that this centralized receipt service is not a trend being implemented temporarily but is part of the change gradually taking effect in the restaurant industry. The adoption of receipt systems will continue to grow with technology within the restaurant industry, ultimately leading to efficiency, improved customer satisfaction, and overall business success. The scalability of centralized receipt services provides excellent potential for expanding the application of this solution to the restaurant domain. It is crucial because of the shift in customers' buying attitudes and innovations that require these systems. Further, changes such as Artificial Intelligence integration in consumer services create new opportunities for innovation within the organization's operations and output services to the consumer. Centralized receipt systems will be significant as the restaurant industry undergoes more digitization [55-68].

Conclusion

The centralized receipt service has many advantages for restaurant businesses, mainly in handling receipts, eliminating downward expenses, and boosting customer satisfaction. Centralizing the receipt tools in restaurant businesses would help overcome some of the most significant drawbacks of paper-based systems, such as inefficient storage, improper filing, and high relational costs. It ensures easy access to the receipt data, constant transaction monitoring, and enhanced reporting effectiveness, which are critical requirements for today's restaurants, mainly operating in environments that churn high daily transactions. Moreover, embracing the new order through digital receipts aligns with sustainable development goals focusing on environmental conservation. The utilization of Go Gin and AWS Lambda in the receipt service guarantees the receipt service scalability, versatility, and security in its operation. In other words, by adopting cloud-based platforms, restaurants can meet growing amounts of receipt data with no space problems. AWS Lambda ensures that the restaurants have an easily scalable serverless infrastructure in their business setup, and Go Gin enables the efficient processing of receipts in real-time. Also, security measures, including customer data encryption and adherence to standards like GDP ensureure, ensure that the restaurant's customers' information will not be leaked and that the restaurant is GDPR compliant.

From the customers' point of view, the receipt service is more centralized, which is a significant advantage. Facilities like Pay-by-bus, SMS-based electronic receipts, and web-based interfaces optimized for mobile users allow customers to view their transaction records. It reduces wait time, improves customer satisfaction, and encourages. Because more customers seek digital experiences in all spheres of service delivery, restaurants that adopt the systems will be in a better shape to address emerging customer needs. The future perspective features new possibilities for advancing the centralized receipt service based on its connection with artificial intelligence and individual approach to the consumers. With further expansion of the restaurant market, this system will also receive more importance in increasing productivity and customer satisfaction. In summary, the centralized receipt service, in addition to having excellent solutions for today's operational issues in the restaurant, provides the groundwork on which opportunities for growth and development can be built in the future.

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